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Academic Outcomes of Public and Private High School Students: What Lies Behind the Differences?

by Marc Frenette and Ping Ching Winnie Chan

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Marc Frenette and Ping Ching Winnie Chan

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Table of contents

Abstract 5

Executive summary 6

1 Introduction 7

2 Literature review 8

3 Data and methodology 10

4 The characteristics of public and private high schools and their students 13

5 Results 18

6 Conclusion 23

References 24

Abstract

This study examines the roles played by student characteristics, school resources and practices, peer effects, and province fixed effects in accounting for differences in the academic outcomes of private and public high school students. Private high school students score significantly higher than public high school students on reading, mathematics, and science assessments at age 15, and have higher levels of educational attainment by age 23. Two factors consistently account for these differences. Students who attended private high schools were more likely to have socio-economic characteristics positively associated with academic success and to have school peers with university-educated parents. Province of school attendance accounted for a substantial portion of the differences in academic outcomes measured in high school (i.e., test scores and high school graduation rates), but generally not at the postsecondary level. School resources and practices accounted for little of the differences in academic outcomes.

Executive summary

There is considerable interest in the differences in academic outcomes of children who attend private and public schools, and the factors underlying these differences. For instance, if the academic outcomes of private high school students exceed those of public high school students, is this because of differences in student characteristics or in school resources and practices?

Many studies that have attempted to answer this question have used data sets containing detailed information on students, but virtually no information on schools. Consequently, these studies have accounted for student characteristics and interpreted the residual differences in academic outcomes as the effect of private schools.

This study advances the literature by using a dataset that contains information not only on students and their parents (including aspects of their home life), but also on school resources and practices, and province of school attendance. Furthermore, information about the students' peers is available. This level of detail facilitates the examination of the roles played by student characteristics, school resources and practices, peer effects, and province fixed effects in accounting for differences in the academic outcomes of private and public high school students.

Data from the Youth in Transition Survey, Cohort A (YITS-A) and the Programme for International Student Assessment (PISA) are used to follow students from age 15 to 23. Several academic outcomes are assessed, including test scores in reading, mathematics, and science at age 15; and at age 23, high school graduation, postsecondary attendance and graduation, university attendance and graduation, and participation in graduate or professional studies.

Private high school students score significantly higher than public high school students on reading, mathematics, and science assessments at age 15, and have higher levels of educational attainment by age 23. Two factors consistently account for these differences. Students who attended private high schools were more likely to have socio-economic characteristics positively associated with academic success and to have school peers with university-educated parents. Province of school attendance accounted for a substantial portion of the differences in academic outcomes measured in high school (i.e., test scores and high school graduation rates), but generally not at the postsecondary level. School resources and practices accounted for little of the differences in academic outcomes.

1 Introduction

In Canada and the United States, about 6% of 15-year-olds attend a private school, defined as a school under the control of a private entity.[1] Governments may subsidize some of the costs, but in general, parents must pay more to send their children to a private school.

There is considerable interest in the differences in academic outcomes of children who attend private and public schools, and particularly in the factors underlying these differences. For instance, if academic outcomes are indeed better among students from private schools, to what extent is this attributable to the characteristics of students and their families or to schools themselves?

Many studies have attempted to answer this question, and these are described in detail in the literature review. For the most part, researchers have used data sets containing fairly comprehensive information on students, but little information about schools. Consequently, these studies have typically accounted for student characteristics and interpreted any remaining differences in educational outcomes as the result of school characteristics.

The current study advances the literature by using a dataset that contains information not only about students and their parents (including aspects of their home life), but also about school resources and practices. Furthermore, information about the students' peers is available. This level of detail allows for a more comprehensive assessment of the roles of student and school characteristics in explaining differences in the academic outcomes of private and public high school students.

Private high school students scored significantly higher than public high school students on reading, mathematics, and science assessments at age 15, and by age 23, had higher levels of educational attainment. Two factors consistently accounted for the differences in academic outcomes between public and private sector students: socio-economic characteristics and peers. Students who attended private high schools were more likely to have socio-economic characteristics positively associated with academic success and to have school peers with university-educated parents. Private schools were concentrated in certain provinces (and thus, must follow the provincial curriculum in order to grant provincially recognized high school diplomas), but had resources and practices similar to those of public schools. The province of school attendance accounted for a substantial portion of the differences in academic outcomes measured in high school (test scores and high school graduation rates), but generally, not at the postsecondary level. School resources and practices played little to no role in accounting for the differences in academic outcomes.

This study is organized as follows. Section 2 reviews the literature. The data and research approach are discussed in Section 3. Section 4 describes private schools in Canada. Results are presented in Section 5. Finally, the conclusion summarizes the study and suggests potential follow-up research.

1. This is based on the Programme for International Student Assessment (PISA), which sampled 15-year-old youth in schools in 2000 (OECD 2011).

2 Literature review

Comparisons of student outcomes for private and public schools are common in the economics of education literature. Hanushek (2002) notes that the two fundamental analytical questions in the literature are: 1. Does performance in private schools exceed that in public schools, all else being equal?, and 2. If private school performance exceeds that in public schools, is it because of better schools or better students?

Both questions are challenging. Uncovering the causal relationship between school type and student outcomes is complicated by the possibility of self-selection into private schools. Given the costs of private schools, wealthier families may be better able to enroll their children. Furthermore, private schools may have more stringent academic admission criteria. Another limiting factor is a general lack of data, particularly about the school themselves.

Early U.S. studies were largely descriptive, and the data generally lacked a comprehensive set of covariates, notably, information pertaining to schools. Researchers accounted for differences in the students who attended private and public schools, and residual differences in outcomes were, by default, ascribed to differences in school quality.

Based on data from the High School and Beyond, 1980 survey in the United States, Coleman, Hoffer and Kilgore (1982)[2] used ordinary least squares (OLS) estimation to assess the impact of Catholic schooling (which is privately provided in the United States)[3] on cognitive achievement, and found a positive association. Their model accounted for several socio-economic characteristics: household composition, maternal work patterns before and when the child was in elementary school, ethnicity, number of siblings, frequency of talking with mother or father about personal experiences, parental thoughts on child attending college, family income, maternal and paternal education, number of rooms in the home, presence of an encyclopedia in the home, number of books in the home, typewriter in home, and child ownership of a pocket calculator. Noell (1982) argued that the results in Coleman, Hoffer and Kilgore (1982) were not robust to additional variables, namely, sex, handicap status, region of residence, and early college attendance expectations. Noell found that after adding these variables, the impact of private Catholic school attendance on senior and sophomore cognitive outcomes was generally not statistically significant.

More recently, Grogger and Neal (2000) used the National Education Longitudinal Study of 1988 (NELS:88) to analyze high school and postsecondary academic outcomes in relation to student characteristics and achievement at the end of elementary school. They found associations between private Catholic high school attendance and high school graduation rates and college attendance among urban minorities. Horowitz and Spector (2005) examined the impact of private versus public high schools on the academic performance of 15,270 undergraduates registered at Ball State University. They found a slightly higher grade point average among students who went to a religious private high school, compared with their private and public school counterparts. However, the relationship weakened as students proceeded through college, and disappeared entirely by junior or senior year.

In addressing the issue of selective school choice, Evans and Schwab (1995) and Neal (1997) explore the use of instrumental variables in a bivariate probit model setting. Evans and Schwab (1995) use affiliation with the Catholic church as their instrument and found a strong positive effect of private Catholic school attendance on high school graduation and on the probability of starting college, based on data from the High School and Beyond, 1980 survey. However, they acknowledged that being Catholic could also be correlated with neighbourhood and family characteristics that could impact school effectiveness. Neal (1997) observed that another

2. The main focus here is on high schools since this is the focus of the current study.
3. Religious schools comprised 85% of U.S. private school enrollment in 1990 (U.S. Department of Education 1992).

problem in using Catholic affiliation is that religious identification might also be affected by the type of school the student attended. Based on data from the National Longitudinal Survey of Youth of 1979 (NLSY79), he used the interaction between whether a person is Catholic and two additional county-level measures of geographic proximity to private Catholic schools to identify the exogenous effect of private Catholic schooling. His main conclusion was that private Catholic schools were similar in quality to suburban public schools and slightly better than the urban public schools that white students usually attend. However, private Catholic schools were much better than the urban public schools that many minorities attend, a finding later echoed in Horowitz and Spector (2005).

Using the NELS:88 dataset, Altonji, Elder and Taber. (2005a) explored the validity of religious affiliation and the geographic proximity measures as exogenous sources of variation in identifying the private Catholic school effect. Their findings suggested that none of the instruments are useful in identifying a causal private Catholic school effect.[4]

More recent American studies used existing data on private schooling to address the lack of exogenous variation in school choice. For example, with the NELS:88 data, Altonji, Elder and Taber (2005b) examined the association between private Catholic school attendance and several outcomes, including twelfth-grade reading and mathematics tests scores, high school graduation, and college attendance. They had several demographic covariates, but again, no school-level variables. Based on the hypothesis that the amount of selection on the observed covariates can be used to bound the amount of selection on the unobserved covariates, they found that private Catholic schools substantially raise the probability of graduating from high school, and more tentatively, attending college. However, they found no evidence of an association between private Catholic school attendance and test scores.

Elder and Jepsen (2014) used the Early Childhood Longitudinal Study – Kindergarten Class of 1998-99 (ECLS-K) to assess the effect of private Catholic primary schooling on cognitive and non-cognitive outcomes measured between kindergarten and the eighth grade. They presented evidence that the private Catholic school advantage in cognitive and non-cognitive outcomes was entirely due to selection bias. Their approach followed the selection on unobservables method developed by Altonji, Elder and Taber (2005b), as well as various propensity score matching techniques. Once again, school-level characteristics were absent from their study.

Hsieh and Urquiola (2006) examined a comprehensive voucher program introduced in Chile in 1981. The program disbursed funds to non-tuition-charging private schools, essentially placing them on an equal footing with public schools in terms of per-student funding. Although these private "voucher schools" could not charge tuition, unlike public schools, they had wide latitude in selecting students. Moreover, they could receive outside donations, whereas public schools could not. The authors took advantage of the fact that the voucher program had a larger impact on school enrolment decisions in larger, more urban, and wealthier communities. The results of the study suggested that the program led to a large increase in voucher school enrolment and increased sorting (that is, the best public school students left for voucher schools), but no improvements in educational outcomes were detected.

Perhaps the cleanest example of a causal study in this literature comes from Angrist et al. (2002), who assessed the impact of the Columbian private secondary school voucher program. In this case, the funds were disbursed directly to students attending private schools. Because many of the vouchers were awarded by lottery, issues of selectivity likely do not exist in this research. The results suggested that winning a voucher lottery was associated with increased educational attainment. The authors observed that this finding may be specific to a country like

4. They also showed that the nonlinearity embedded in the bivariate probit model is the main source of identification when using the geographic proximity instruments and suggested that bivariate probits might sometimes produce results that are consistent with a powerful instrumental variable, but, in fact, the underlying identification came from the functional form assumption of the model.

Columbia, which has a weak public-school infrastructure and a well-developed private school system.[5]

The current study contributes to the literature by being the first to directly assess the roles of both student and school characteristics. The data contain detailed student, parental and home environment information, as well as school resource and practice indicators. Furthermore, the student data are collected within schools, which allows for the creation of peer-level covariates (another school-level factor).[6] In this study, peer effects are considered a school-level characteristic because they result from the school's ability to attract specific types of students.[7]

This analysis contributes to the smaller, less developed Canadian literature on the topic. The annual School Report Card released by the Fraser Institute in Alberta, British Columbia, Ontario, and Quebec ranks schools based on standardized provincial exam scores. The reports adjust for a limited number of local socio-economic characteristics. For example, the Ontario analysis adjusts for average family income at the postal-code level. However, evidence suggests that parents of children who attend Ontario private schools tend, on average, to be more highly educated than parents of children who attend Ontario public schools (Van Pelt, Allison and Allison 2007). Previous research has shown that parental education is a much stronger correlate of child educational success than family income (e.g., Frenette 2007).

Johnson (2005) advanced the Ontario analysis by accounting for a more detailed set of socio-economic characteristics at the local level (including educational attainment) and concluded that about 25% of the variation in school assessment results was associated with observable community-level measures.

However, the main issue in using province-wide assessments to rank schools is that private schools are generally not obliged to participate in these assessments. For example, only five private schools appear in the Ontario data for the 2011/2012 Ontario secondary school ranking in the Fraser Institute report. For the current study, participation was voluntary for *both* the public and private sectors.

3 Data and methodology

The data for this study are from the Youth in Transition Survey, Cohort A (YITS-A) and the Programme for International Student Assessment (PISA).[8] The Organisation for Economic Co-operation and Development (OECD) designed PISA, which was administered throughout OECD countries. In Canada, the YITS-A was developed by Statistics Canada to add contextual background information on students and their parents.

The target population consisted of students born in 1984. The YITS-A–PISA sample was derived from a two-stage, stratified random sampling design administered in the 10 provinces. In the first stage, a provincially stratified random sample of schools where students born in 1984 were enrolled was taken in April or May of 2000. The list of schools was provided by each

5. A few American states have also adopted a private school voucher system targeted at students, but none are based on a true lottery. Rouse (1998) presented an overview of impact evaluations of the first voucher program in the United States: the Milwaukee Parental Choice Program.
6. The NLSY79 also contains school-level data for a smaller sample. However, no studies have used these data to examine differences between the academic outcomes of students in the public and private sectors.
7. Hanushek et al. (2003), Betts and Zau (2004), and Burke and Sass (2013) use detailed data on students and schools and find evidence of positive effects of peer backgrounds on student test scores.
8. Details on the YITS–PISA data are available from Statistics Canada (2005).

provincial Ministry of Education and included private schools.[9] Overall, 93.6% of schools agreed to participate—1,187 in total.[10]

Within each school, a random sample of students born in 1984 was taken (whether or not they were in Grade 10). Of these, 86.6% participated in PISA and responded to the PISA and YITS surveys; 90.6% of their parents responded to the YITS parental questionnaire. The final sample of students who participated in PISA and YITS in cycle 1 was 29,330.

Sample weights were adjusted for school non-response by public/private and urban/rural status; for student non-response by public/private status of the school and by reading ability; and for parental non-response by family structure, an index of wealth (from student reports of the availability of various items in their home), and the reading ability of the student.

The PISA portion involved a two-hour written test of reading, followed by a test of either mathematics or science. All students took the reading test, which was the main focus of the overall assessment. Immediately after the reading test, about half of the students were randomly assigned to the mathematics test, and the other half, to the science test. The PISA assessment focused on the practical application of knowledge that students are expected to acquire in the classroom. Exam results were standardized to have an average of 500 and a standard deviation of 100 across OECD countries. A background survey was also administered to students and to school administrators.

In 2000 (cycle 1), the YITS-A consisted of a student questionnaire (to complement the PISA student survey), and a parent questionnaire. Students were re-interviewed every two years on five separate occasions (cycles 2 through 6). The addition of these follow-up surveys, which were unique to Canada, allowed for the measurement of educational attainment outcomes, such as high school graduation, and postsecondary attendance and graduation.

The analytical sample consists of students in Grade 10 in cycle 1 (the usual grade for students born in 1984) who were sampled in the spring of 2000. This measure eliminates from the sample students who were held back or skipped a grade. Because very few students in the sample attended private schools in the Atlantic provinces, the analytical sample was further limited to students who attended school in the other provinces, where private school enrolment is more common.[11] The final sample consisted of 560 private high school students and 6,582 public high school students.[12,13]

The outcomes in this study are the PISA test scores in reading, mathematics, and science, and several educational attainment outcomes observed in YITS-A cycle 5 in 2008, when students were aged 23.[14,15] For the test scores, the natural logarithm (log) is used. Differences in log

9. Some schools were excluded, such as schools on Indian reserves and other schools for which it would be infeasible to administer the survey (for example, home schooling and special needs schools). Such exclusions represented fewer than 4% of 15-year-olds in Canada.
10. Because this number is not available by sector, it is not possible to determine if the participation rate was the same across sectors. However, both sectors could opt out, which is generally not the case in provincial standardized tests.
11. The Atlantic provinces are Newfoundland and Labrador, Prince Edward Island, Nova Scotia, and New Brunswick, together accounting for 7.9% of 15-year-olds in Canada in 2000 (CANSIM table 051-0001).
12. The mathematics and science samples are about half as large.
13. The samples are not large enough to break down results by type of private school (e.g., sectarian versus non-sectarian).
14. Overall attrition was 63% by cycle 6, compared with 50% by cycle 5. Longitudinal weights are available to account for attrition bias, but adjustments can be made only on observed characteristics: province, some schooling-related information like social participation, overall scores, etc., and family structure and social network variables (Statistics Canada 2009). Because other factors may matter, and because the attrition rate is high, the cycle 6 sample may not yield meaningful results.
15. Sample weights are used throughout the analysis. Separate weights are used for the reading, mathematics and science samples. In all cases, cycle 5 weights are used because this is the base sample used throughout the study. Also,100 bootstrap weights are applied for variance calculations.

values can be interpreted as percentage differences for small values (which is the case in the current study). The educational attainment outcomes are measured with dummy (binary) variables indicating high school graduation, postsecondary and university attendance and graduation, and graduate or professional studies).

The key independent variable consists of a dummy variable to distinguish between private and public high schools. High schools are classified as private if they are under the control of a private entity, which was determined from the school (principal) questionnaire. The degree of public versus private funding is not a factor in classifying schools—what matters is who decides how the school is operated.

The analysis initially presents unadjusted differences in academic outcomes. However, many factors may explain these differences. First, students who attend private schools may come from very different family backgrounds than their public sector counterparts. Second, this self-selection into private schools may also manifest itself through peer effects—the influence of peers on an individual's academic performance. Third, private and public schools may have different resources, or they may follow different academic practices. Finally, private schools are not concentrated in the same provinces as public schools, and so a relatively large share of them follow a specific provincial curricula.

The gaps in outcomes are estimated when these factors are taken into account in step-wise OLS regressions.[16] The order in which these factors enter the model can provide useful insight. By accounting for province fixed effects and student socio-economic characteristics first, the remaining gap in academic performance between private and public school students can be roughly interpreted as the estimated marginal impact of private school attendance.

For each of the four factors (provincial fixed effects, socio-economic characteristics, school resources and practices, and peer effects) several covariates are included. For the province fixed effects, only provinces outside of Atlantic Canada are included in this study, because low sample sizes limit analysis for the Atlantic provinces. The socio-economic characteristics of students include dummy variables indicating sex, immigrant status, visible minority status, presence of disability, province of school attendance, and urban versus rural residence. Other socio-economic variables are measured at the family level, and include dummy variables for family composition (one parent; two parents, not both biological; two parents, both biological), a dummy variable indicating the presence of at least one immigrant parent, equivalent total (pre-tax) parental income, and dummy variables indicating the highest level of parental education (high school or less, non-university postsecondary certificate, bachelor's degree, graduate or professional degree), the number of books in the home (10 or fewer, 11 to 50, 51 to 100, 101 to 250, 251 to 500, and more than 500), and the number of computers in the home (none, one, two, and three or more).

School resources and practices include being a sectarian (religious) school, delivering programs in semesters, total enrolment, student–teacher ratio, total annual instructional hours, number of computers per student, percentage of teachers with an undergraduate degree, percentage of English/French teachers with an undergraduate degree in English/French language and literature, percentage of certified teachers, percentage of teachers who participated in training in the last three months, and dummy variables indicating whether special tutoring is available from staff members, degree to which low teachers' expectations hinder learning (not at all, a little, and some or a lot), and frequency of feedback to parents (less than three times a year, three

16. When the outcome is binary (for example, high school graduation), logit and probit models are estimated in addition to the OLS (linear probability) model. Marginal probability effects are similar in all three models.

times a year, and four or more times a year).[17] Again, information on these characteristics was provided by principals.

Peer effects are approximated by the percentage of 15-year-olds in the school (other than the individual in question) whose highest level of parental educational attainment is postsecondary graduation. The effect of peers is a form of school-level influence, in that it reflects the school's ability to attract students who may exert a positive influence on their peers.

To quantify the contribution of the province fixed effects, socio-economic factors, school resources and practices, and peer effects, a simple Blinder-Oaxaca decomposition is estimated. The total gap between private and public school students in each outcome is decomposed into the proportion accounted for by each of these factors (the differences in the mean levels of these factors, multiplied by the coefficient associated with the factor, in a pooled model where the dependent variable is the outcome in question).

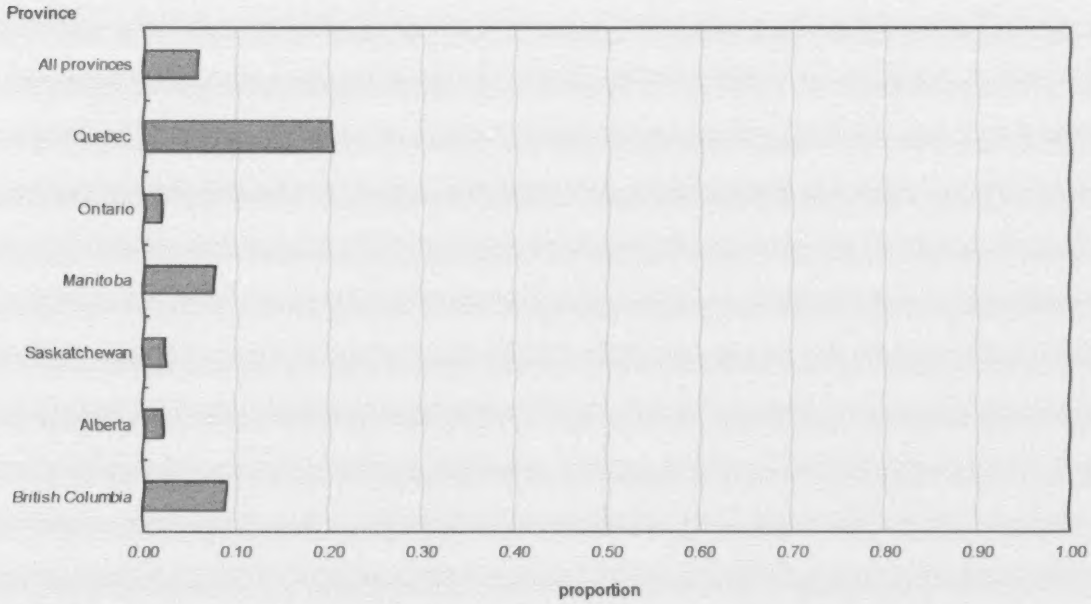
4 The characteristics of public and private high schools and their students

Following the definition in the PISA data for this study, a private school (also known as an independent school) is a school whose affairs are under the control of a private entity. Private high schools must offer the same curriculum as the public sector in order to confer provincial secondary diplomas.

From the YITS-A data in this study, the percentage of students enrolled in private schools across the 10 provinces in the sample can be computed. The sample consists of students who attended Grade 10 in one of the 10 provinces in April or May 2000; 6% of this sample were enrolled in private schools (Chart 1). At 20%, the percentage in private schools was highest in Quebec. In British Columbia, 9% of Grade 10 students in the sample were in private schools. The percentages were lowest in the Atlantic provinces (less than 1% in each province). The focus of this analysis is on the six provinces where private school attendance is more common: Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

17. Dobbie and Fryer (2013) used a small sample of charter schools (schools that receive public funding but operate independently) in New York City to demonstrate that the traditional resource-based model of education, which focuses on class size, per pupil expenditures, the fraction of teachers with no teaching certification, and the fraction of teachers with an advanced degree, is not positively correlated with school effectiveness. However, they found that an index of five policies—frequent teacher feedback, the use of data to guide instruction, high-dosage tutoring, increased instructional time, and high expectations—explains about 45% of the variation in school effectiveness. From the list provided above, the YITS-A–PISA data used in the current study allow for the creation of variables closely related to these non-traditional factors except for the use of data to guide instruction (which was not statistically significant in the Dobbie and Fryer study).

Chart 1
Proportion of students attending a private high school, by province



Notes: The sample consists of individuals who were born in 1984, were in Grade 10, lived in Canada (excluding the territories) in April or May 2000, and responded to a follow-up survey in 2008. Results are not shown individually for the Atlantic provinces because they are less than 0.01.
Sources: Statistics Canada, Youth in Transition Survey, Cohort A, and Organisation for Economic Co-operation and Development, Programme for International Student Assessment.

The characteristics of students attending public and private schools, as well as the characteristics of schools themselves, are central to discussions regarding the educational outcomes of these groups.

The fact that private schools generally rely on tuition fees to cover their operating costs may lead to issues of self-selection if wealthier families are in a better position to pay. This may also be the case in jurisdictions that provide partial operating funding for private schools if certain criteria are met, or that provide subsidies to students who require special education only available outside of public schools. Ariely (2008) cites several experiments indicating that demand for a good drops considerably when the price increases from zero to a marginal amount.

In addition to tuition fees, private schools' admission criteria may be more stringent, which may also lead to selection issues. According to the PISA data, 89% of private school students attended schools that include academic merit in their admission policy, compared with 59% of public school students. These results support the premise that students were higher-achieving even before they entered private schools.

Table 1 provides information on the socio-economic characteristics of students enrolled in public and private high schools. Students attending private schools were more likely to have background characteristics associated with educational success. For example, compared with public school students, higher percentages of private school students lived in two-parent families with both biological parents; their total parental income was higher; and they tended to live in homes with more books and computers. Students attending private schools were also more likely to live in an urban area. However, private schools had relatively fewer girls than

public schools, and it is well documented that girls are more likely to eventually pursue university studies.[18]

Table 1
Student socio-economic characteristics, by type of high school attended

	Public high school	Private high school
	mean	
Female	0.508	0.459
Immigrant	0.082	0.092
Member of a visible minority group	0.130	0.151
Often has a disability	0.018	0.012
Rural residence	0.238	0.128
One parent	0.154	0.140
Two parents, not both biological	0.115	0.076
Two parents, both biological	0.731	0.784
At least one immigrant parent	0.285	0.343
Equivalent total parental income (2008 dollars)	35,568	44,628
Highest parental educational level		
High school or less	0.340	0.178
Non-university postsecondary certificate	0.367	0.304
Bachelor's degree	0.195	0.270
Graduate or professional degree	0.098	0.248
Number of books in home		
10 or fewer	0.045	0.032
11 to 50	0.157	0.128
51 to 100	0.206	0.135
101 to 250	0.245	0.273
251 to 500	0.211	0.266
More than 500	0.136	0.165
Number of computers in home		
None	0.081	0.026
1	0.558	0.515
2	0.269	0.325
3 or more	0.091	0.135

Notes: The sample consists of individuals who were born in 1984, were in Grade 10, lived in Canada (excluding the Atlantic provinces and the territories) in April or May 2000, and responded to a follow-up survey in 2008. Income is divided by the square root of family size to obtain equivalent income.

Sources: Statistics Canada, Youth in Transition Survey, Cohort A; and Organisation for Economic Co-operation and Development, Programme for International Student Assessment.

The characteristics of private and public schools attended by students in the sample also differed (Table 2). Private schools were more likely to be sectarian (81% versus 32%) and less likely to follow a semester mode (26% versus 69%). Although average student enrollment was considerably lower in private schools, the student–teacher ratio was slightly higher than in public schools (17.8 versus 17.0). The average annual number of instructional hours was moderately lower in private schools (945 versus 968). The average number of computers per student was slightly higher in private schools (20.1 versus 19.1).

18. See Frenette (2007) for the relationship between parental background and university attendance, Frenette (2003) for the relationship between distance to school and postsecondary attendance, and Frenette and Zeman (2007) for the relationship between sex and university attendance.

The percentage of teachers with an undergraduate degree and the percentage who participated in training in the three months before the survey were lower in private schools. Finally, the percentage of teachers who were certified was similar in both sectors.

Table 2
School resources and practices, peer characteristics, and province of school attendance by type of high school attended

	Public high school	Private high school
	mean	
Sectarian	0.318	0.806
Semestered	0.692	0.255
Enrolment	1,079.9	712.8
Student–teacher ratio	17.0	17.8
Total annual instructional hours	967.6	945.1
Number of computers per student	0.191	0.200
Percentage of teachers with an undergraduate degree	93.0	87.1
Percentage of English/French teachers with undergraduate degree in English/French language and literature	81.9	81.3
Percentage of certified teachers	96.7	97.1
Percentage of teachers participated in training in last three months	59.3	52.3
Special tutoring available from staff members	0.796	0.798
Low expectations from teachers		
Does not hinder learning at all	0.528	0.716
Hinder learning a little	0.383	0.279
Hinder learning some or a lot	0.089	0.005
Teacher feedback		
Less than three times per year	0.014	0.000
Three times per year	0.035	0.057
Four or more times per year	0.950	0.943
Percentage of peers with non-university postsecondary educated parent	43.5	44.6
Percentage of peers with university educated parent	27.7	51.7
Provincial distribution of students		
Quebec	0.157	0.559
Ontario	0.484	0.118
Manitoba	0.040	0.050
Saskatchewan	0.044	0.020
Alberta	0.117	0.029
British Columbia	0.159	0.223

Notes: The sample consists of individuals who were born in 1984, were in Grade 10, lived in Canada (excluding the Atlantic provinces and the territories) in April or May 2000, and responded to a follow-up survey in 2008.

Sources: Statistics Canada, Youth in Transition Survey, Cohort A; and Organisation for Economic Co-operation and Development, Programme for International Student Assessment.

The availability of special tutoring from staff members and the frequency of teacher feedback to parents were about the same in private and public schools. A factor that stands out was the extent to which teachers' low expectations hindered learning: 9% of public school principals reported that low expectations from teachers hindered learning "some" or "a lot," compared with 0.5% of private school principals.[19]

19. This is the only subjective variable used in the present study. Principals were asked to link low expectations from teachers to a school level outcome (learning). The variable was included because it was found to be important by Dobbie and Fryer (2013).

In private schools, 52% of students had peers with a university-educated parent; the comparable figure for public school students was 28%.

While the province where the school is situated can be a proxy for many things, after accounting for socio-economic characteristics of students, school resources and practices, and student peers, it likely picks up curricula effects. Chart 1 showed the proportion of students in each province who attended a private school. The provincial dimension is expressed differently in Table 2, which shows the distribution of private and public high school students among provinces. More than half (56%) of all private school students were in Quebec; close to half (48%) of all public school students were in Ontario.[20] British Columbia accounted for 22% of private school students and 16% of public school students.

Teacher quality is clearly important when discussing school quality. Table 2 shows measures of teacher quality based on formal education, certification, training, and teachers' expectations of students. Another approach is to examine wages (and other job characteristics) by sector. According to efficiency wage models, to raise productivity, some employers may pay more than the market-clearing wage. These premiums ("efficiency wages") may affect productivity in four ways (Akerlof and Yellen 1986). First, a wage premium may reduce the tendency to avoid work, because workers face a higher cost associated with job loss (i.e., their wage loss would be greater since they would lose their premium). Second, workers may be more reluctant to quit a job that pays a wage premium. The motivation is similar to the first point, except it applies to worker turnover more generally. If experienced workers are lost, worker turnover comes at a cost to firms, so reducing its incidence will improve productivity. Third, efficiency wages may create a larger queue of job candidates, which may result in a more productive workforce in the firm. Fourth, a higher wage may boost worker morale, and thus, productivity. In short, it is possible that higher wages are associated with higher worker productivity.

The Labour Force Survey (LFS) was used to track wages and other job characteristics of employed secondary school teachers between 1997 and 2004 (March and September samples). The analytical sample consisted of 5,763 secondary school teachers employed in public schools, and 170 employed in private schools.[21] On average, public school teachers earned higher hourly wages, were more likely to be employed full-time and in a permanent job, and were far more likely to be covered by a collective bargaining agreement and to be part of a union than were their private school counterparts (Table 3).

Table 3
Teacher job characteristics, by type of high school

	Public high school	Private high school	Private high school minus Public high school
	mean		difference
Log of wages (2004 constant dollars)	3.271	3.227	-0.044
Employed full time (30 hours or more per week)	0.832	0.710	-0.122
Employed in permanent job	0.803	0.737	-0.066
Covered by collective bargaining agreement	0.947	0.399	-0.548
Union membership	0.918	0.320	-0.598

Note: The sample consists of teachers who were employed in a secondary school in a Canadian province in March or September in any year from 1997 to 2004.
Source: Statistics Canada, Labour Force Survey.

20. The main results of the study (to follow) are qualitatively similar whether or not students in Quebec are included.
21. The public and private sector were coded manually based on responses to the industry-of-work question on the LFS.

OLS regression results in Table 4, which include covariates for sex, age and age squared, province of residence, establishment size, month, and year, generally confirm the findings in Table 3. Private school teachers earned about 4% less per hour than did public school teachers. They were less likely to be employed full time (8.3 percentage points), and far less likely to be covered by a collective bargaining agreement (55.1 percentage points) or to be union members (60.5 percentage points). However, when the covariates were taken into account, the probability of being in a permanent job no longer differed.[22]

Table 4
Estimated relationship between teacher job characteristics and private high school employment (ordinary least squares regression results)

Outcome variable	Regression results	
	coefficient	standard error
Log of wages (2004 constant dollars)	-0.036 †	0.020
Employed full time (30 hours or more per week)	-0.083 ***	0.023
Employed in permanent job	-0.003	0.023
Covered by collective bargaining agreement	-0.551 ***	0.015
Union membership	-0.605 ***	0.018

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of teachers who were employed in a secondary school in a Canadian province in March or September in any year from 1997 to 2004. All models include covariates for sex, age and age squared, province of residence, year, and month. Reference category is public high school employment.

Source: Statistics Canada, Labour Force Survey.

5 Results

This section compares nine academic outcomes for students who attended private and public high schools.

In the reading test, private school students outperformed their public school counterparts by 0.081 log points, or about 8% (Table 5). The gaps were slightly larger in the mathematics and science tests. By age 23, 99% of private school students had graduated from high school, about 3 percentage points above the figure for public school students. The private school advantage was more evident in postsecondary outcomes (measured at age 23)—postsecondary attendance (11.6 percentage points), university attendance (17.8 percentage points), postsecondary graduation (16.2 percentage points), university graduation (13.9 percentage points), and graduate or professional studies (8.1 percentage points).

22. Further analysis showed that private high school teachers were more likely to live in Quebec, where permanent teaching jobs are relatively scarce, and less likely to live in Ontario, where permanent teaching jobs are more abundant. When province of residence was taken into account (Table 4), the difference in the prevalence of permanent jobs observed in Table 3 disappeared.

Table 5
Academic outcomes, by type of high school attended

Outcome variable	Public high school	Private high school	Private high school minus public high school
	mean		difference
Log of reading score	6.284	6.365	0.081
Log of mathematics score	6.278	6.362	0.084
Log of science score	6.267	6.355	0.088
High school graduation	0.955	0.988	0.034
Postsecondary attendance	0.793	0.909	0.116
University attendance	0.456	0.634	0.178
Postsecondary graduation	0.506	0.667	0.162
University graduation	0.215	0.354	0.139
Graduate or professional studies	0.048	0.130	0.081

Notes: The sample consists of individuals who were born in 1984, were in Grade 10, lived in Canada (excluding the Atlantic provinces and the territories) in April or May 2000, and responded to a follow-up survey in 2008. The test scores were measured at age 15 (in 2000); educational outcomes refer to attainment by age 23 (in 2008).

Sources: Statistics Canada, Youth in Transition Survey, Cohort A; and Organisation for Economic Co-operation and Development, Programme for International Student Assessment.

It is perhaps not surprising that private school students outperformed public school students, given that private school students were more likely to have characteristics positively associated with academic performance and educational attainment, and to have peers with university-educated parents (Table 1).

To demonstrate the role of these characteristics in the gaps between the academic outcomes of private and public school students, Table 6 shows the results of step-wise ordinary least squares regressions. In the first model, no covariates were added. Each outcome is regressed on a dummy variable indicating private school attendance. The estimated coefficients simply replicate the gaps reported in Table 5.

In the second model, province fixed effects variables were added. For earlier outcomes (high school performance and graduation), the result was a considerable reduction in the private school advantage. However, postsecondary outcomes were largely unaltered when province is taken into account. This may be because curriculum effects have a larger role in high school outcomes than in postsecondary outcomes.

Next, the socio-economic characteristics listed in Table 1 were added. In all cases, this substantially reduced the private school attendance coefficients. At this point, the coefficient associated with the private school dummy variable may be interpreted as the private school advantage, since school resources and practices, as well as peer effects, have not been taken into account (two factors associated with school choice). For the early outcomes (test scores and high school graduation), little, if any, private school advantage emerged. However, private high school attendance was positively associated with postsecondary attendance and graduation outcomes. Specifically, postsecondary attendance and graduation outcomes were 5- to 9-percentage-points higher among private high school students.

Table 6
Estimated relationship between academic outcome variables and private high school attendance (ordinary least squares regression results)

Outcome variable	No covariates		Province fixed effects covariates added		Socio-economic covariates added		School resources and practices covariates added		Peer effects covariates added	
	coefficient	standard error	coefficient	standard error	coefficient	standard error	coefficient	standard error	coefficient	standard error
Log of reading score	0.081 ***	0.012	0.057 ***	0.011	0.020 †	0.011	0.034 **	0.011	0.013	0.012
Log of mathematics score	0.084 ***	0.015	0.045 **	0.014	0.007	0.015	0.023	0.015	-0.003	0.017
Log of science score	0.088 ***	0.014	0.063 ***	0.013	0.026 *	0.012	0.027	0.017	0.014	0.017
High school graduation	0.034 ***	0.008	0.020 **	0.006	-0.004	0.007	-0.004	0.011	-0.011	0.013
Postsecondary attendance	0.116 ***	0.020	0.126 ***	0.020	0.050 **	0.019	0.084 ***	0.025	0.053 †	0.028
University attendance	0.178 ***	0.038	0.202 ***	0.037	0.059 †	0.032	0.058	0.036	-0.004	0.036
Postsecondary graduation	0.162 ***	0.034	0.133 ***	0.030	0.087 **	0.028	0.090 **	0.030	0.070 *	0.033
University graduation	0.139 ***	0.028	0.160 ***	0.026	0.078 ***	0.023	0.074 **	0.023	0.037	0.025
Graduate or professional studies	0.081 ***	0.019	0.071 ***	0.018	0.044 **	0.017	0.043 *	0.019	0.029	0.018

* significantly different from reference category ($p<0.05$)

** significantly different from reference category ($p<0.01$)

*** significantly different from reference category ($p<0.001$)

† significantly different from reference category ($p<0.10$)

Notes: The sample consists of individuals who were born in 1984, were in Grade 10, lived in Canada (excluding the Atlantic provinces and the territories) in April or May 2000, and responded to a follow-up survey in 2008. The test scores were measured at age 15 (in 2000); educational outcomes refer to attainment by age 23 (in 2008). Standard errors were estimated with 100 bootstrap weights. Reference category is public high school attendance.

Sources: Statistics Canada, Youth in Transition Survey, Cohort A; and Organisation for Economic Co-operation and Development, Programme for International Student Assessment.

The school resources and practices covariates in Table 2 were added in the fourth model. In most instances, the private school advantage was fairly consistent when differences in school resources and practices were taken into account. In no case did the private school advantage substantially narrow. These results suggest that the school resources and practices that are measured in the data generally do not work in favour of either private or public school students.

The fifth model examined another school-level characteristic—the ability to recruit "quality" students. As shown in Table 2, private schools are more likely to attract students with university-educated parents. When this difference in peers is taken into account, the private sector advantage declines considerably for most outcomes.[23,24,25]

To what extent do differences in these four sets of factors—province of study, socio-economic characteristics, school resources and practices, and peers—contribute to the overall gaps in academic outcomes? The answer can be found in Table 7, which contains the results from Blinder-Oaxaca decompositions of the gaps in each of the nine outcomes. These decompositions are based on the OLS coefficients from Table 6 and the sample means displayed in Tables 1 and 2.

The total gaps are reported in the leftmost column of data. The second column shows the proportion of the total gap in each outcome that can be accounted for by differences in all of the covariates; depending on the outcome, the covariates accounted for 54% to 134% of the total gap. Together, the socio-economic covariates, peer effects, and province fixed effects accounted for 59% to 147% of the total gap. In general, socio-economic characteristics mattered most (accounting for one-quarter to one-half of the gaps), followed by roughly equal contributions from province fixed effects and peer effects. However, province fixed effects matter a great deal for high school outcomes (test scores and graduation rates), but generally less for postsecondary outcomes. This is consistent with the notion that province fixed effects reflect curriculum, which is expected to matter more for test scores and high school graduation rates than for postsecondary attendance.

By contrast, school resources and practices accounted for, at most, 13% of the gaps, and at times, their contribution was negative.

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23. Three propensity score matching estimators yielded similar results to the OLS figures in Table 6. Following Elder and Jepsen (2014), these included a kernel density estimator (where an Epanechnikov kernel type with a bandwidth of 0.08 is specified), a nearest neighbour estimator (with four neighbours), and a caliper estimator (with a radius of 0.0005). In all cases, the average treatment effect on the treated was estimated (the matching estimator yielded the difference in mean outcomes between private school students and their matched counterparts in the public sector).
24. Private schools may confer different benefits to different students. To test this hypothesis, simultaneous quantile regression models were estimated (for each decile) for the log test scores in reading, mathematics, and science. All covariates were included in these models, except school resources and practices, and peer effects. The estimated coefficients may thus be attributed to the school. The coefficients were roughly the same throughout the test score distribution. Results from inter-quantile significance tests suggested that in only 5 of a possible 108 cases were the coefficients statistically significant (10% or less) across quantiles.
25. As shown in Table 2, private schools were far more likely than public schools to be sectarian (religious). However, OLS regression models that omitted school factors provided no statistical evidence of a difference in academic outcomes between private sectarian and private non-sectarian schools.

Table 7
Proportion of gap in academic outcomes between private and public high school students accounted for by differences in covariates (decomposition results)

Outcome variable	Total gap (private high school minus public high school)	Proportion of gap accounted for by differences in: All covariates	Province fixed effects covariates	Socio-economic covariates	School resources and practices covariates	Peer effects covariates	Unobserved factors
				proportion			
Log of reading score	0.081	0.840	0.293	0.271	-0.007	0.283	0.160
Log of mathematics score	0.084	1.032	0.523	0.270	-0.084	0.324	-0.032
Log of science score	0.088	0.841	0.255	0.286	0.130	0.170	0.159
High school graduation	0.034	1.337	0.722	0.527	-0.137	0.224	-0.337
Postsecondary attendance	0.116	0.544	0.084	0.409	-0.238	0.290	0.456
University attendance	0.178	1.025	-0.009	0.547	0.123	0.364	-0.025
Postsecondary graduation	0.162	0.566	0.320	0.203	-0.090	0.133	0.434
University graduation	0.139	0.735	-0.010	0.421	0.054	0.270	0.265
Graduate or professional studies	0.081	0.646	0.165	0.248	0.056	0.177	0.354

Notes: The sample consists of individuals who were born in 1984, were in Grade 10, lived in Canada (excluding the Atlantic provinces and the territories) in April or May 2000, and responded to a follow-up survey in 2008. The test scores were measured at age 15 (in 2000); educational outcomes refer to attainment by age 23 (in 2008).

Sources: Statistics Canada, Youth in Transition Survey, Cohort A; and Organisation for Economic Co-operation and Development, Programme for International Student Assessment.

6 Conclusion

It is well documented that private high school students generally outperform their public school counterparts in the academic arena. But does this reflect the quality of the private schools or the quality of the students they attract? This study attempts to answer the question by analyzing detailed student background and school-level information that has generally not been available in large datasets. This is the first study to directly compare the relative contributions of both students and schools to differences between the academic outcomes of students in private and public schools.

At age 15, private high school students scored significantly higher than did public high school students on reading, mathematics, and science assessments, and by age 23, had higher levels of educational attainment. However, the students who attended private high schools were more likely to have socio-economic characteristics positively associated with academic success, and to have school peers with university-educated parents. Private schools were concentrated in certain provinces (and so had to follow the provincial curriculum), but had similar resources and practices as public schools. Two factors consistently accounted for the differences in academic outcomes between public and private sector students: socio-economic characteristics and peers. The province of school attendance accounted for a substantial portion of differences in academic outcomes in high school (test scores and high school graduation rates), but generally not at the postsecondary level. School resources and practices played little to no role in the differences in any academic outcome.

An important research question remains unanswered. Specifically, do private high school students outperform their public school counterparts in the labour market? The higher rates of postsecondary attendance among private high school students may translate to higher lifetime earnings (Frenette 2014). This effect may be amplified through peers. A social network of gainfully employed friends may improve an individual's chances of securing a well-paying job. The YITS-A–PISA data used in this study provide little information about this question, since students were not followed beyond their mid-20s.[26]

26. The only possibility would be through record linkage involving the YITS-A–PISA data and income tax data.

References

Abadie, A., and G.W. Imbens. 2006. "Large sample properties of matching estimators for average treatment effects." *Econometrica* 74 (1): 235–268.

Akerlof, G.A., and J. Yellen. 1986. *Efficiency Wage Models of the Labor Market*. Cambridge; New York: Cambridge University Press.

Altonji, J., T. Elder, and C. Taber 2005a. "An evaluation of instrumental variable strategies for estimating the effects of Catholic schooling." *Journal of Human Resources* 40 (4): 791–821.

Altonji, J., T. Elder, and C. Taber. 2005b. "Selection on observed and unobserved variables: Assessing the effectiveness of Catholic schools." *Journal of Political Economy* 113 (1): 151–184.

Angrist, J., E. Bettinger, E. Bloom, E. King, and M. Kremer. 2002. "Vouchers for private schools in Colombia: Evidence from a randomized natural experiment." *American Economic Review* 92 (5): 1535–1558.

Ariely, D. 2008. *Predictably Irrational: the Hidden Forces That Shape Our Decisions*. New York: HarperCollins.

Betts, J.R., and A. Zau. 2004. *Peer Groups and Academic Achievement: Panel Evidence from Administrative Data*. Unpublished manuscript.

Burke, M.A., and T.R. Sass. 2013. "Classroom peer effects and student achievement." *Journal of Labor Economics* 31 (1): 51–82.

Coleman, J., T. Hoffer and S. Kilgore. 1982. *High School Achievement: Public, Catholic and Private Schools Compared*. New York: Basic Books.

Dobbie, W., and R.G. Fryer, Jr. 2013. "Getting beneath the veil of effective schools: Evidence from New York City." *American Economic Journal: Applied Economics* 5 (4): 28–60.

Elder, T., and C. Jepsen. 2014. "Are Catholic primary schools more effective than public primary schools?" *Journal of Urban Economics* 80 (1): 28–38.

Evans, W.N., and R.M. Schwab. 1995. "Finishing high school and starting college: Do Catholic schools make a difference?" *Quarterly Journal of Economics* 110: 947–974.

Frenette, M. 2003. *Access to College and University: Does Distance Matter?* Analytical Studies Branch Research Paper Series, no. 201. Statistics Canada Catalogue no. 11F0019M. Ottawa: Statistics Canada.

Frenette, M. 2007. *Why Are Youth from Lower-income Families Less Likely to Attend University? Evidence from Academic Abilities, Parental Influences, and Financial Constraints.* Analytical Studies Branch Research Paper Series, no. 295. Statistics Canada Catalogue no. 11F0019M. Ottawa: Statistics Canada.

Frenette, M. 2014. *An Investment of a Lifetime? The Long-term Labour Market Premiums Associated with a Postsecondary Education.* Analytical Studies Branch Research Paper Series, no. 359. Statistics Canada Catalogue no. 11F0019M. Ottawa: Statistics Canada.

Frenette, M., and K. Zeman. 2007. *Why Are Most University Students Women? Evidence Based on Academic Performance, Study Habits and Parental Influences.* Analytical Studies Branch Research Paper Series, no. 303. Statistics Canada Catalogue no. 11F0019M. Ottawa: Statistics Canada.

Frenette, M., and W. Chan. 2015 *Why are Academic Prospects Brighter in Private High Schools?* Economic Insights, no. 044. Statistics Canada Catalogue no. 11-626-X. Ottawa: Statistics Canada.

Grogger, J., and D. Neal. 2000. "Further evidence on the effects of Catholic secondary schooling." *Brookings-Wharton Papers on Urban Affairs*, p. 151–193.

Hanushek, E.A. 2002. "Publicly provided education." In *Handbook of Public Economics,* ed. A.J. Auerbach and M. Feldstein. Amsterdam: North-Holland.

Hanushek, E.A., J.F. Kain, J.M. Markman, and S.G. Rivkin. 2003. "Does peer ability affect student achievement?" *Journal of Applied Econometrics* 18 (5): 527–544.

Horowitz, J.B., and L.C. Spector. 2005. "Is there a difference between private and public education on college performance?" *Economics of Education Review* 24 (2):189–195.

Hsieh, C.-T., and M. Urquiola. 2006. "The effects of generalized school choice on achievement and stratification: Evidence from Chile's voucher program." *Journal of Public Economics* 90 (2006): 1477–1503.

Johnson, D. 2005. *Signposts of Success: Interpreting Ontario's Elementary School Test Scores.* Policy Study 40. Toronto: C.D. Howe Institute. 235 p.

Organisation for Economic Co-operation and Development (OECD). 2011. "Private schools: Who benefits?" *PISA in Focus 7.* Paris: OECD. Bulletin.

Neal, D. 1997. "The effects of Catholic secondary schooling on educational attainment." *Journal of Labor Economics* 15 (1): 98–123.

Noell, J. 1982. "Public and Catholic schools: A reanalysis of public and private schools." *Sociology of Education* 55 (2/3): 123–132.

Rouse, C.E. 1998. "Schools and student achievement: More evidence from the Milwaukee Parental Choice Program." *Economic Policy Review* 4 (1): 61–76.

Statistics Canada. 2005. *Youth in Transition Survey 2000: YITS Reading Cohort, Cycle 1, User Guide, Revised September 2005.* Ottawa: Statistics Canada.

Statistics Canada. 2009. *Youth in Transition Survey (YITS) Cohort A - 23-year-olds, Cycle 5: User Guide.* Ottawa: Statistics Canada.

U.S. Department of Education. 1992. *Private School Universe Survey, 1989-90.* Washington, D.C.: National Center for Education Statistics.

Van Pelt, D.A., P.A. Allison and D.J. Allison. 2007. *Ontario's Private Schools: Who Chooses Them and Why?* Studies in Education Policy. Fraser Institute Occasional Paper. Vancouver, B.C.: The Fraser Institute.